National Oceanic and Atmospheric Administration (NOAA)

Concept of Operations (CONOPS)
For
NPOESS Data Exploitation (NDE)

Version 2.0

Prepared by:

U.S. Department of Commerce

National Oceanic and Atmospheric Administration (NOAA)

National Environmental Satellite, Data, and Information Service (NESDIS)

NOAA/NESDIS

3/14/2006

Approval Page

Document Numbers: DCN OSDNDECO 2.0	**MMDDYY**

Document Title Block:

National Oceanic and Atmospheric Administration (NOAA) **CONCEPT OF OPERATIONS** for National Polar-orbiting Operational Environmental Satellite System (NPOESS) Data Exploitation (NDE)

PROGRAM: NPOESS Data Exploitation (NDE)	**DOCUMENT RELEASE DATE:** August 12, 2005
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Change Record Page

Document Title: NOAA CONOPS for NPOESS Data Exploitation Document Date: June 1, 2004			
Issue	Date	Pages Affected	Description
1.2	5/10/04	all	Provided more specific reference to NDE, fewer to NPOESS.
1.3	5/12/04	all	***Eliminated 10 pages of text*** • Deleted Section 1.3 System Overview • Deleted Section1.4 NESDIS Information Service Enterprise • Changed Section 2. User Oriented Description To 2. Background. Deleted much text Renamed 4 Data Processing Operational Overview To 3 NOAA Organizational Overview • Renamed graphic 4.1 to 3.1 and drew dotted box around NDE functions • Deleted (from this section) definition of SDS • Deleted Section 4.1.1 ESPC • Deleted Section 4.1.2 Field Terminal • Deleted Section 4.1.3 Long Tem Archive (LTA)
1.4	5/13/04		• Created new Operational Overview Diagram (top of Section 3) • Edited as per Tom Schott's suggestions
1.4	5/14/04		• Inserted S Bunin edits • Inserted J Silva edits
1.6	6/7/04		Added sections 3.2.2 through 3.2.2.4
1.8	9/8/04		
2	8/03/05		Complete rewrite, using Standard IEEE format and excerpts from the Project Plan

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1 Scope

1.1 Document Purpose

This ConOps is a user-oriented document that describes system characteristics for the proposed NPOESS Data Exploitation (NDE) system from the users' viewpoint. The document is used to communicate overall quantitative and qualitative system characteristics to the user, developers, and other NOAA stakeholder in Line Offices and in support organizations. It describes the NDE mission and organizational objectives from an integrated systems point of view.

The contents are organized according to "IEEE Standard 1362-1998 IEEE Guide for Information Technology – System Definition- Concept of Operations (CONOPS)."

1.2 Background

The National Oceanic and Atmospheric Administration (NOAA) Polar-orbiting Operational Environmental Satellite (POES) and the Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP) will be replaced by the National Polar-orbiting Operational Environmental Satellite System (NPOESS) in the next decade. NPOESS will provide environmental remote sensing capability for both civilian and military applications.

NPOESS will provide data to four central processing facilities, called "Centrals," via its Interface Data Processing Segment (IDPS) and to remote field terminals via direct radio links. The Centrals will be responsible for providing NPOESS data to environmental satellite users.

NOAA's National Environmental Satellite, Data and Information Service (NESDIS) will operate the NOAA Central. Air Force Weather Agency (AFWA), Fleet Numerical Meteorology and Oceanography Center (FNMOC), and Naval Oceanographic Office (NAVOCEANO) will operate the other three Centrals.

NOAA's NPOESS Data Exploitation (NDE) system will receive data from the NPOESS IDPS, process and package it to meet user requirements, ensure NDE unique products are archived, distribute data to authorized users, and provide customer service to users of its products.

1.3 Project Goals and Objectives

NDE's primary mission is to provide products derived from NPOESS observations to NOAA's operational and climate communities and to other civilian customers. In order to fulfill the mission, NDE will acquire the resources necessary to achieve the following objectives:

- Disseminate NPOESS Data Records to customers
- Generate and disseminate tailored NPOESS Data Records (versions of NPOESS Data Records in previously agreed alternative formats and views)
- Generate and disseminate NOAA-unique products (augmented environmental products constructed from NPOESS Data Records)

- Deliver NOAA-unique products and associated metadata to the NOAA Long-Term Archive
- Provide services to customers, including a Help Desk, NDE product training, product enhancement, and implementation support across NOAA
- Coordinate NPOESS-related activities across NOAA
    - Assist with planning for the implementation of NPOESS data by user systems
    - Ensure end-user preparedness for NPOESS data
- Perform the NOAA Lead Central role for the development and verification of processing capability
- Develop a sustainable system that meets its customer needs
- Provide software for NPOESS Data Record format conversion and other data manipulations

Two National Weather Service (NWS) field terminals will be installed for NPOESS: one in Alaska and one in Hawaii. These terminals incorporate much of the IDPS software and have the capability, therefore, of providing remote sites with NPOESS data through a direct pathway to the satellites rather than through NDE, the NOAA Central. These terminals incorporate NPOESS software, will receive and process real-time data broadcast directly from NPOESS satellites while the satellites are within the field terminals lines of sight. The nature of NDE’s support for these two field terminals is to be determined (TBD).

2 Reference Documents

- NOAA's NPOESS Data Exploitation Charter http://projects.osd.noaa.gov/nde
- NPOESS IPO, Integrated Operational Requirements Document II (IORD II), version 6, 2002.
- NPOESS to National Oceanic and Atmospheric Administration (NOAA) Interface Control Document (ICD), NPOESS Draft, 03/03/2005, NO. D31413, Rev C.
- Information Processing Division National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Concept Of Operations, Baseline Issue, June 20, 2002, Version 1 http://216.33.118.202/EPSData/DOC/Synopses/3055/NOAA-ESPC-04-04-2003/AppendixE.pdf
- National Oceanic and Atmospheric Administration Information Quality Guidelines, September 30, 2002, http://www.noaanews.noaa.gov/stories/iq.htm
- Concept of Operations (CONOPS) for the National polar-orbiting Operational Environmental Satellite System (NPOESS) Program,
- Version 1.2, September 15, 2003
- NPOESS DATA EXPLOITATION (NDE) SYSTEM REQUIREMENTS, 13 August 2004
- NPOESS Integrated Operational Requirements Document (IORD)-II, 10 December 2001
- NPOESS Concept of Operations, Draft, February 21, 2003
- Comprehensive Large Array-data Stewardship System (CLASS) Archive, Access and Distribution System Allocated Requirements, Version 1
- NESDIS, A Strategic Approach for the New Millennium, 2001
- Concept of Operations for the National Environmental Satellite, Data, and Information Service: 2010-2020, 2002
- Interface Requirements Document (IRD) for National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) Science Data Segment (SDS) and Interface Data Processing Segment (IDPS) Interface, GSFC 429-00-02-13, July 23, 2001
- NPOESS Operations Concept (OPSCON), TRW D31400, 1 August 2002
- NPOESS to NESDIS ICD, Northrop Grumman Space & Mission Systems Corp. Space Technology, 23 May 2003
- Concept of Operations for the Archive, Access and Distribution System As part of Comprehensive Large Array-data Steward-ship System (CLASS) Version 1, CLASS-1004-CLS-REQ-CONOP, October 25, 2002

Comprehensive Large Array-data Stewardship System (CLASS) Dual Site Architecture and Operational Concept (1.0), CLASS-1038-CLS-RPT-DLSTE, June 27, 2003Current Systems

3 Current System

NPOESS is the follow-on to both NOAA's National Polar orbiting Operational Environmental Satellite (POES) system and its military counterpart, the Defense Meteorological Satellite Program (DMSP). The primary mission of the Polar-orbiting-Operational Environmental Satellite (POES) system is to provide daily global observations of weather patterns and environmental measurements of the Earth's atmosphere, its surface and cloud cover, and the proton and electron flux at satellite altitude; and to establish long-term data sets for climate monitoring and change predictions. Since the beginning of the POES program, environmental data and products acquired by its satellites have been provided to users around the globe.

<u>The Current Polar Ground System</u>

Today, the NOAA Polar Ground System (PGS) receives telemetry and science data from a large array of Low Earth Orbiting (LEO) satellites. In addition, the PGS controls the LEO set of satellites using various commanding schemes. The vast array of LEO satellites consists of NOAA's legacy Polar-orbiting Operational Environmental Satellites (POES) and DoD's Defense Meteorological Satellite Program (DMSP). Also, the PGS is collecting data from various non-NOAA satellites such as Advanced Earth Observing Satellite (ADEOS), Earth Observing System (EOS), Jason, Quick Scatterometer (QuikSCAT), Sea-viewing Wide Field-of-view Sensor (SeaWiFS), Tropical Rainfall Measuring Mission (TRMM), WindSat/Coriolis, and etcetera.

Instruments that are carried aboard the satellites mentioned above perform measurements of temperature and humidity in the Earth's atmosphere, surface temperature, cloud cover, water-ice boundaries, greenhouse gases, and proton and electron flux near the Earth. The POES satellites also have a capability, via their on-board Argos system, of receiving, processing, and retransmitting data from weather balloons, buoys, and remote automatic data collection stations distributed around the world. In addition, the POES satellites have an onboard Search and Rescue transponder and processor for receiving transmissions from people in distress.

The PGS is comprised of the Satellite Operations Control Center (SOCC) and Environmental Satellite Processing Center (ESPC) located in Suitland, Maryland, and the NOAA Command and Data Acquisition (CDA) Stations at Fairbanks, Alaska (FCDAS), and Wallops Island, Virginia (WCDAS). Command and data acquisition control of the polar-orbiting and geostationary operational satellites is conducted from the SOCC, through communications links with the ground system facilities at the CDAS.

NOAA polar satellite data are processed centrally at the Suitland, Maryland site within the ESPC.

NOTE: For NPOESS, the SOCC and its links to the CDAs will be replaced by new facilities, to be described later in this document. The proposed NDE Systems are "back end" only, and will be implemented using only one segment of the current PGS, the ESPC in Suitland, Maryland.

The global images are processed into polar stereographic and Mercator maps of cloud cover. The sounding data are processed for use by the National Meteorological Center (NMC) and placed on the Global Telecommunication System (GTS) for national and international distribution. Drivers of Change

4 Justification for Proposed Changes

4.1 Consolidation and Cost Savings

The U.S. Government has been merging the Nation's military and civil operational meteorological satellite programs into a single, integrated, satellite system capable of satisfying both civil and national security requirements for space-based remotely sensed environmental data. Under direction of the National Performance Review (NPR) and the Presidential Decision Directive-2 (May 1994), the missions of the existing DoD Defense Meteorological Satellite Program (DMSP) and the NOAA POES programs are being combined and replaced by NPOESS.

The Integrated Program Office (IPO) is a management organization with responsibility for developing, acquiring, managing and operating the NPOESS satellites as well as the ground systems necessary for capturing, processing, and delivering the data to the Centrals, including NDE. IPO coordinates the interests of the three NPOESS stakeholder agencies; the Department of Commerce (DOC), the National Aeronautics and Space Administration (NASA), and the Department of Defense (DoD). IPO has established an umbrella, performance-based contract with Northrop Grumman Space Technologies (NGST) for all of these tasks. Under the terms of the contract, NGST and their subcontractor Raytheon are Shared System Performance Responsibility (SSPR) partners with the Government. (NGST/Raytheon will be referred to as "the SSPR" throughout this document.)

NESDIS, in participation with the DoD, the National Weather Service (NWS), and other user agencies, defined and documented a set of requirements to jointly meet the needs of the nation's civil and military users for polar satellite data. These requirements are documented in the NPOESS Integrated Operational Requirements Document (IORD). The IORD identifies 56 atmospheric, oceanic, terrestrial, climatic, and solar-geophysical data products and related attributes to guide the development of advanced technology instrumentation. The new NPOESS sensors will provide enhanced capabilities to users and improve the accuracy and timeliness of observations.

4.2 Technology Improvements

NPOESS will provide new and improved remote sensing data in comparison to existing polar satellites. The NPOESS space segment consists of a new suite of instruments:

- Visible-Infrared Imager Radiometer Suite (VIIRS)
- Conical Microwave Imager Sounder (CMIS)
- Cross-Track Infrared Sounder (CrIS)
- Advanced Technology Microwave Sounder (ATMS)
- Ozone Mapping and Profiling Suite (OMPS)
- Earth Radiation Budget Sensor (ERBS)
- Space Environment Sensor Suite (SESS)
- Aerosol Polarimetry Sensor (APS)
- Altimeter (Alt)
- Advanced Data Collection System (A-DCS)
- Search And Rescue Satellite Aided Tracking (SARSAT)

- Survivability Sensor (SS)

Because there will be so many new instruments introduced over the course of the NPOESS program, the first satellite in the program will be unique in that it will not be certified as operational. The purpose of the first satellite is to mitigate the risks presented by all of the new technologies that will be implemented for NPOESS, not to provide operational products. In 2008, the risk-reduction NPOESS Preparatory Project (NPP) satellite will be launched. NDE will use products from the NPP satellite to develop product prototypes, a distribution network, and the core of its product packaging systems.

On the ground, fundamental technology changes will require new modes of data processing. NPOESS will have a new ground station architecture that will provide more data at a faster rate. By 2013, NPOESS will deliver about 8 terabytes of data to NESDIS every day. The products will be available for assimilation into user systems within minutes of observation instead of hours. Through the use of the 'SafetyNet' Command, Control, and Communications (C^3) concept (Figure 1), providing automated, schedule-driven connectivity to the Space Segment through 15 globally distributed commercial Stored Mission Data (SMD) receptors linked to the Centrals via commercial fiber optic communications lines, the time from observation to delivery of Environmental Data Records (EDRs) to the user will be dramatically reduced under NPOESS. It is anticipated that greater than 77% of the data will be delivered in 15 minutes from observation, and 95% of the data delivered within 28 minutes; average data delivery will be less than 10.5 minutes. This compares to current delivery times of 35 to 135 minutes from observation for the most commonly used polar satellite products. Two or three times a day, a current polar satellite's orbit does not bring it within transmitting range of a ground station. The interval between delivery and observation for these "blind orbits" is 236 to 336 minutes. There will be no blind orbits during NPOESS.

These very short latency periods will not apply during the NPP period, since the SafetyNet is not scheduled to be operational until the first NPOESS satellite is flown. The data from the NPP satellite, therefore, will be routed to NDE from a ground station located at Svalbard, Norway. NPP data will be available within 35 to 135 minutes after observation. Since Svalbard is at high latitude, there will no NPP blind orbits.

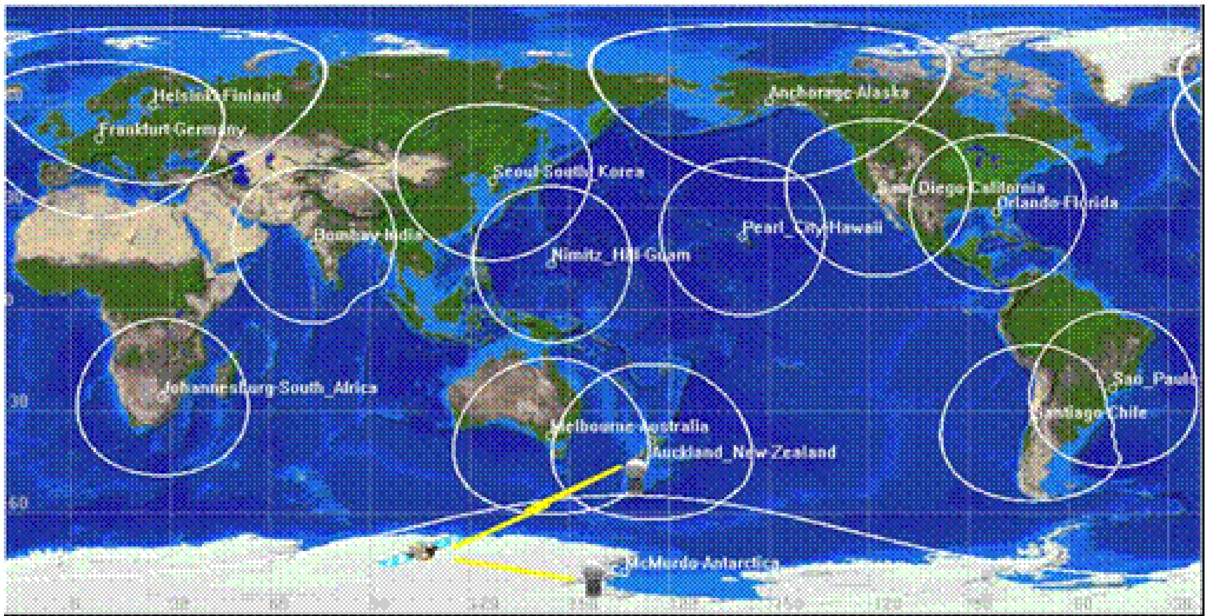

Figure 1: NPOESS SafetyNet

4.3 Implications for the User Community

Improved Weather Forecasts and Hazard Warnings - The ability to receive high-resolution data from polar satellites within minutes of observation is expected to significantly improve the accuracy and timeliness of weather forecasts and hazard warnings.

New Research and Development - Measurements and richer detail of NPOESS instrument observations will create opportunities for experimentation and innovative analyses of environmental models.

Upgraded Information Systems - Organizations who would like to take advantage of these opportunities will upgrade their systems to accommodate the NPOESS environmental products and data sets.

Informed Climate Policy - Over the long term, the higher resolution data and new observations will provide better data for climate studies which, in turn, will provide policy makers with the ability to make decisions based on better information.

5 Concepts for the Proposed System

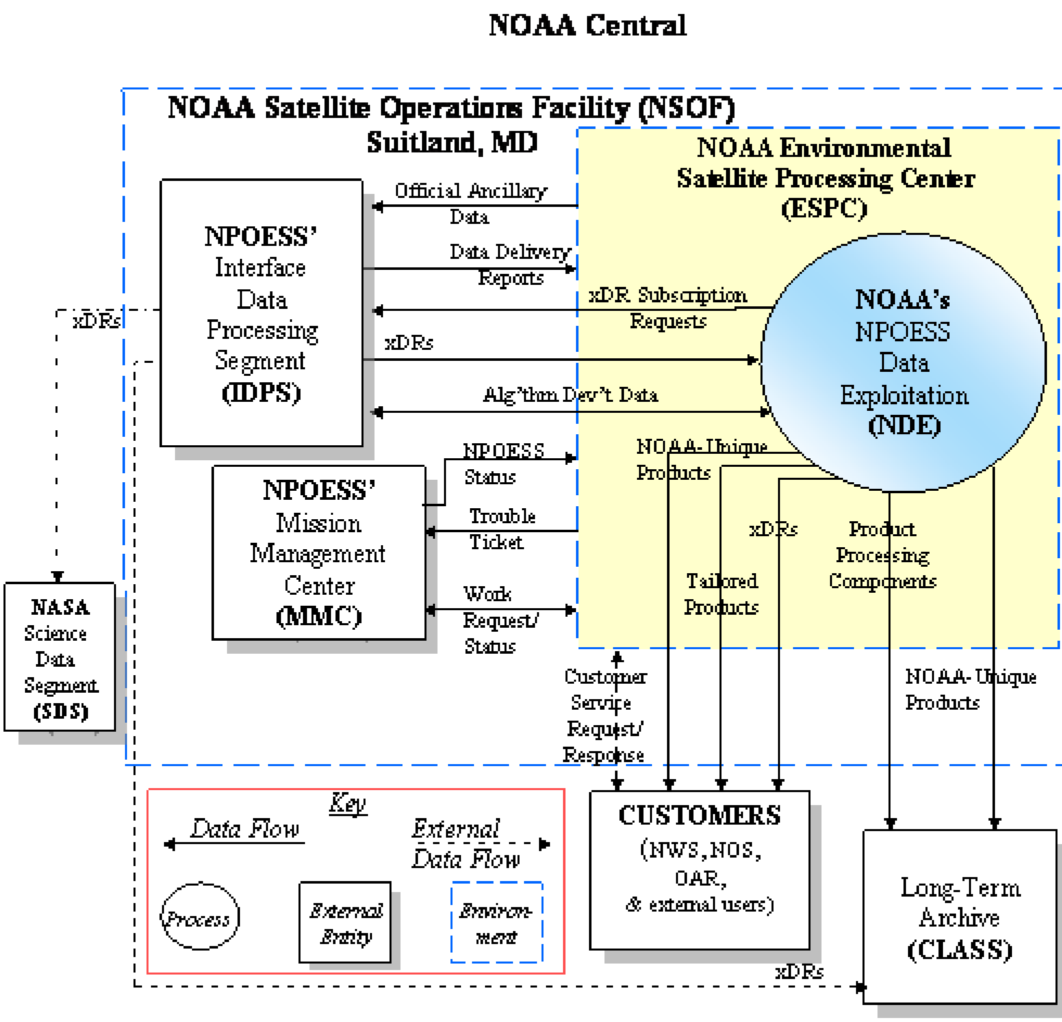

Figure 2: NOAA Central

5.1 NOAA Satellite Operations Facility (NSOF)

The NOAA Satellite Operations Facility (NSOF) is located in Suitland, Maryland, providing facilities for satellite command and control and for the generation and distribution of products derived from satellite data. The facility provides operational capabilities for NOAA satellites, as well as for various non-NOAA satellites including those of America's foreign scientific partners under the terms of various treaties and agreements. The NOAA Central, as well as the NPOESS Command, Control and Communications Segment (C3S), will be at NSOF.

For NPOESS and NPP, NOAA provides the floor space, a secured facility and connectivity to the NPOESS spacecraft through roof-mounted antennae. The costs and responsibilities for connectivity to Svalbard and the SafetyNet through exclusive fiber optic networks will be borne by IPO. IPO also assumes the costs and responsibilities for internet and other telecommunications between Suitland and other Centrals.

Stored Mission Data (SMD) will be delivered to NOAA from the NPOESS downlink facility, and passed through a firewall into the IDPS. Firewalls will also be required between the IDPS and the NDE system, the LTA, and possibly NASA's Science Data Segment (SDS) (an entity responsible for the generation of Climate Data Records (CDRs) from the NPP satellite). Firewalls will be maintained separately by the SSPR, to prevent unauthorized access via NOAA connections, and by NESDIS to protect against incursions from the NPOESS side.

The two NPOESS systems at NSOF are the Mission Management Center (MMC) and an instance of the Interface Data Processing Segment (IDPS). The SSPR will acquire all necessary equipment for these systems and will have full and exclusive responsibility for their operation.

NESDIS has operational responsibility for the Environmental Satellite Processing Center (ESPC) and all of the systems that use its infrastructure, including NDE. NDE will be logically separate in the sense that its processing will be segregated. The resources that NDE will use to accomplish its mission are those of the ESPC environment.

5.2 NPOESS Interface Data Processing Segment (IDPS)

The IDPS is a hardware/software suite that is capable of producing the full set of NPOESS products. The collective name for the various data records that are generated by the IDPS is "xDR." Metadata, consistent with Federal Geographic Data Committee (FGDC) standards, is attached to each record. The xDR record types are categorized as follows:

Raw Data Record (RDR) – An RDR is the IDPS first phase product. It is a full resolution digital sensor data file, time referenced, with radiometric and geometric calibration coefficients appended, but not applied, to the data. Aggregates (sums or weighted averages) of detector samples are considered to be full resolution data if the aggregation is normally performed to meet resolution and other requirements. [Sensor data will be unprocessed with the following exceptions: time delay and integration, detector array non-uniformity correction (i.e., offset and responsivity equalization), and data compression.]

Temperature Data Record (TDR) – A TDR is an intermediate IDPS product created from the application of algorithms to microwave sensor RDRs. It consists of geolocated, antenna temperatures with all relevant calibration data counts and ephemeris data. TDRs also provide an audit trail from the raw data (RDR) to the TDR.

Sensor Data Record (SDR) – A SDR is an intermediate IDPS product resulting from the application of an algorithm to non-microwave sensor RDRs. It consists of geolocated and calibrated brightness temperatures/radiances with associated ephemeris data. SDRs provide an audit trail from the raw data (RDR) to the SDR.

Environmental Data Record (EDR) - An EDR is the end product of complete IDPS processing. It is a collection of data that represents one or more related environmental variables, generally referenced to the source location. Environmental variables are reported in physically significant units at the source, and geometrically referenced with respect to the Earth or another appropriate coordinate reference system.

Each EDR will include metadata, data that describes and provides context for the subject data.

Application-Related Product (ARP) – ARP is a subcategory of an EDR. An ARP is an application of another EDR. ARPs are subject to the same requirements as EDRs.

Intermediate Product (IP) - An IP is produced by the IDPS during the process of generating an EDR. Although not specified in the IORD, a selected group of IPs will be made available as end products by the IDPS.

(**NOTE:** For reference purposes, Figure 2 shows two external data flows from the IDPS. These are outside the scope of this document and will not be described. They are the flow of xDRs to NOAA's Comprehensive Large Array-data Stewardship System (CLASS) for long-term archiving and a similar xDR data flow will provide NASA with NPOESS products.)

Therefore, the IPO is singularly responsible for the entire IDPS operation and all the configurations/inputs used in that operation. This includes

- Acquiring, installing, operating, monitoring, trouble-shooting and maintaining the IDPS
- Managing and controlling the IDPS configuration. (Although each IDPS will maintain a revolving archive that stores IDPS products produced over the last 24 hours, this capacity is primarily in support of internal IDPS operations. It can be used to support the NOAA Central on an emergency/contingency basis. However, since the interface is bandwidth and processor constrained, it is not intended to serve as an on-line data repository/database for the Central.)
- Distributing patches and new versions of the IDPS software
- Acquiring, installing, and maintaining the hardware suite for the Algorithm Development Area (ADA)
- Training NOAA Central personnel on how to configure and operate the ADA.
- Managing the prioritization of IDPS enhancements/new capabilities within the NPOESS Configuration Control Board (CCB) process.
- Managing the Engineering and Manufacturing Development (EMD) Contractor and Operations and Support (O&S) contractors (as applicable), who are responsible for:
    - Tuning IDPS algorithms
    - Calibrating all data
    - Monitoring and providing quality control of products
    - Identifying ancillary data requirements and sources and coordinating with external agencies to make necessary ancillary data available
    - Supporting the NOAA Central in enhancing its local exploitation of NPOESS products, but only as funded by the Centrals under separate tasking

A Memorandum of Understanding (MOU) between the NOAA Central and the IPO will capture hosting arrangements/constraints where the IPO's ability to provide services is reliant upon the NOAA Central. The IPO is responsible for initially coordinating and updating the MOU with the NOAA Central to ensure the operation and hardware maintenance of NPOESS elements.

5.3 NDE Product Generation and Dissemination

NOAA customers will be the recipients of NPOESS products according to their data requirements and NOAA products will be disseminated to them according to their preferences. Creation and dissemination of these products to customers are the core missions of NDE.

5.3.1 NDE Product Data Flows

The xDR Data Flow - The IDPS is a hardware/software suite that is capable of producing the full set of NPOESS products. The collective name for the various data records that are generated by the IDPS is "xDR." Metadata, consistent with Federal Geographic Data Committee (FGDC) standards, is attached to each record. Customers may opt to receive products exactly as provided by the IDPS.

The Tailored Product Data Flow - Products tailored by NDE provide alternative views of the data record to facilitate assimilation by the customers' systems. Whenever possible, NDE will provide the software to enable the end users to do the tailoring on their own systems. Many, however, will prefer to have NDE do this tailoring. NDE will offer customers the following tailoring options:

- Format: NPOESS' IDPS will deliver all products to NESDIS in Hierarchical Data Format 5 (HDF5), a standard used by only a few of NESDIS' customers. Optional formats will include: HDF5, BUFR, geoTIFF, NETCDF
- Alternative map projections (Polar Stereographic, Mercator)
- Coverage areas (Global, Regional, Local)
- Aggregations (Daily, Weekly, Monthly)
- Grid Spacing (xyz, qjr)
- Compression approaches (None, JPEG, MPG, etc.)

The NOAA-unique Data Flow - NOAA-unique product development is necessary to support missions that are specific to NOAA, as opposed to data used by all Centrals. NOAA-unique products are augmented environmental products constructed from NPOESS Data Records. They will be generated by procedures (e.g., algorithms) that use NPOESS Data Records (xDRs) as a basis of products containing data values that are different from those in the xDRs as received from NPOESS. NDE will generate NOAA-unique products by combining products from different data sources to provide other environmental information.

NDE will receive Search and Rescue Satellite Aided Tracking (SARSAT) telemetry from the NPOESS satellites. The telemetry will be routed to NOAA's U.S. Mission Control Center (USMCC) in Suitland, Maryland without any tailoring.

5.3.2 Enterprise Tools

NDE software developers will identify and deliver shareable, reusable data processing capabilities. These capabilities are necessary in order to reduce the risks associated with developing and operating many product generation applications in a single environment. NOAA will not treat each NPOESS product generation system as a unique challenge. Rather, NDE seeks to establish a common tool set that will allow the scientific product development teams to focus on the science, using functionality available to all of them to perform the more mundane data processing tasks.

These capabilities will operate within NESDIS' ESPC. NDE will cooperate closely with ESPC, whose contract vehicles will be used to procure the technologies that enable both the development and the operation of NDE's enterprise capabilities. In this relationship, NDE provides the requirements for technologies such as:

- Relational Data Base Management System (RDBMS)
- Object Repositories
- Fourth Generation Languages
- Test Tools
- Configuration Management Systems
- Work Management Tools Schedulers
- Help Desk Software
- Reporting tools
- Process/Project Management tools
- Etc.

As the initial, primary users of these technologies, NDE will assist ESPC operations staff to configure, install, and test the products in the appropriate environments.

The NPP satellite's products offer ESPC opportunities to prototype some of the high performance computing, high volume data management, and product distribution capabilities that will be required for ESPC. The first geostationary satellite to carry the new technologies, GOES R, is not scheduled for launch until 2013 - after C1 and C2 are already operational. NDE, therefore, is the first project that will deliver the next generation of satellite products using ESPC capabilities.

5.3.3 Algorithm Development

Within the Enterprise NDE system, the key executable elements are the algorithm objects, the unique software that is specifically developed to process each xDR. The Enterprise Tools (above) are there to reduce the amount of coding and testing the algorithms will require. Because of the very broad Customer base and the anticipated high demand for NPOESS products, NDE will coordinate the identification, prioritization, and high-level management of the many algorithm development projects that NOAA will conduct during the NPP and NPOESS eras.

The algorithm development projects will, for the most part, be conducted by the NESDIS Office of Research and Applications (ORA). Science teams from across NOAA will also develop algorithms using the NDE Enterprise Toolset.

An important algorithm development project prioritization factor is whether an EDR has been designated as a Key Performance Parameter (KPP). Products in this category have been identified by the user community in the IORD as the most important deliverables from the NPP/NPOESS program. KPPs are:

- Atmospheric Vertical Moisture Profile
- Atmospheric Vertical Temperature Profile
- Imagery
- Sea Surface Temperature
- Sea Surface Winds
- Soil Moisture

During NPP, NDE will release as many products as possible so NOAA customers can take advantage of the risk reduction opportunity to upgrade their systems. These quasi-operational releases will begin toward the end of 2008, soon after the IDPS begins feeding xDRs to the NDE system.

5.3.3.1 Algorithm Development on the IDPS Algorithm Development Area

NOAA scientists and developers will have access to an IDPS capability known as the Algorithm Development Area (ADA). The ADA is situated within the IDPS' Integration and Test (I&T) string. Uses of the I&T String include

- Redundancy in case of Operations string failure
- Algorithm development capability
- Installation and testing of new baselines prior to promotion to Operations
- Transition support for new baselines and technology insertion
- Operator training and certification
- Parallel operations

The NPOESS I&T String is identical to an Operations String except that the Operations (Ops) String has a 100% reserve capacity. The two strings are connected to one another through two IBM Federation Switches that allow high-speed data transfers between the two strings. While each string contains large capacity disk storage, each storage subsystem is also shared between strings. This interconnectivity and shared disk storage allows the Ops String to transfer processing over to the I&T String in the event that the Ops String experiences a total failure. Access to the ADA will not be allowed in circumstances if the I&T String is being used by the

NPOESS program concurrent with the Ops String. This will occur when new IDPS software versions are being tested.

The Algorithm Development Area (ADA) consists of one or more domains using the Integration and Test (I&T) IDP string where the domains are used for software development activities in support of developing algorithm modifications and prototype algorithms. The ADA provides:

- Software development area and tools to develop/modify algorithms
- Existing NPOESS algorithms source for modification
- Algorithm "templates" to develop new algorithms in IDPS I-P-O (Input-Processing-Output) format
- Lightweight versions of Infrastructure and Data Management
    - Enables algorithm execution without full IDP software
    - Infrastructure controls algorithm via command line/file interface, logging and status
    - Data Management provides utilities to populate and provide access to storage

The algorithm development environment allows development of prototype algorithms by NESDIS using operational SMD and algorithm specific test data. Beta EDR algorithms developed in the ADA can be migrated to the parallel operations string within I&T resources where they can be applied to SMD data.

In the event of a "total" failure of OPS server, the IDPS operator dumps all processes running on the I&T machine, reboots the I&T server, points the I&T to appropriate disk storage, loads the IDP software system into the I&T server, and continues operation. The I&T String then effectively replaces the OPS String as the current operations string.[12] **Note** that there is disk storage on the I&T string specifically set aside for algorithm development; it is preserved throughout the operations process and available to the ADA when the I&T string is returned to service.

5.4 NOAA Environmental Satellite Processing Center (ESPC)

ESPC's responsibilities include:

- NDE operations:
    - infrastructure acquisitions
    - technology support
    - product generation
    - product distribution
    - telecommunications
    - customer service
    - product order management

[12] Prototype algorithms must be compatible with and execute under the deployed baselined operating system, i.e., AIX 5.n.

- Continuity of operations for the above in the event of normal operational failure
- Provide System Development infrastructures
    - Algorithm development/test
    - Enterprise tool development/test

- Implement and operate a stand-alone System Test Environment
    - Replicate all significant characteristics of the Operational Environment
    - Provide a temporary backup environment in which products can be generated and distributed to customers in the event of operational environment failure
    - Evaluate candidate system elements for operational fitness, performing appropriate
        - Parallel tests
        - Stress Tests
        - Regression Tests
    - Certify candidate system elements for operational fitness

NDE will be responsible for providing requirements and specifications for all of the technologies needed for these environments. The NDE Project Manager will direct funds to OSDPD for these purposes. The NDE System Architect provides guidance and direction to ESPC personnel in the following domains:

- Software Engineering
- NDE product generation requirements
- NDE systems management requirements
- NDE infrastructure requirements
- NDE data retention and archive requirements
- NDE external interfaces
- NDE communications and distribution requirements

Depending on decisions to be made in the context of NDE's System Architecture, as well as ESPC's design efforts with regard to shared data processing and collaborative environments, some development equipment may be installed at remote sites. ESPC will provide authorized developers with high speed access to NSOF development resources (test databases, Configuration Management (CM) tools, documentation libraries, procedure libraries, etc.).

5.4.1 Security

ESPC is responsible for the security of NDE's Operational, System Test, and Development capabilities. ESPC will establish and enforce security procedures to ensure the data integrity of all operational and developmental applications that run under its auspices, including NDE's. ESPC provides protection from access to NDE's automated resources by unauthorized users. ESPC will withhold specified NPOESS datasets from unauthorized users when so ordered by National Command Authority (e.g., data access). Aside from these data access requirements (TBD), NDE has no security requirements different from those ESPC will provide for all of the applications that operate under its auspices.

5.4.2 Data Base Administration

ESPC will provide maintenance and support for a selected Database Management System (DBMS) as well as of the data content to be established on that system. NDE is committed to sharing this essential resource with all of NOAA. The NDE System Architect will coordinate the creation of data models by the various development organizations (CLASS, ORA, ESPC, NOAA's National Data Centers, NDE product developers, etc.). The Architect's coordination activities will focus on the identification of as many opportunities to share and reuse the maximum number of data entities and object classes. This coordination of conceptual data models is the foundation of NDE's "enterprise approach." In turn, ESPC's database administrators (DBAs) will be responsible for maintaining the integrity of the operational forms of the models – the data itself.

5.4.3 Disaster Recovery

ESPC will develop an ability to recover from disruptions of NDE product deliveries and services resulting from disasters. NDE has no disaster recovery requirements different from those ESPC will provide for all of the applications that operate under its auspices.

5.4.4 Customer Services

ESPC will provide customer services including:

- Product order tracking
- Management of trouble reports (logging and appropriate follow-up)
- Routing of customer product inquiries to qualified specialists

At the present time, NDE has no customer service requirements different from those ESPC will provide for all of the applications that operate under its auspices. However, NDE may levy the following customer service requirements on ESPC if requested during Customer Coordination Phases of NDE Build Cycles:

- Product order placement
- Service request management such as:
    - Capturing enhancement requests
    - Managing the resolution process for determining whether to undertake an enhancement
    - Conducting customer satisfaction surveys
    - Maintaining a database of customer requests to enable reporting by customer, by product, by request type, by status, and by date
- Management of online product training materials and other distance learning capabilities
- Extending operator working hours to provide customer assistance beyond eight hours on week days

ESPC will negotiate Service Level Agreements (SLA) with all of its product customers. These agreements will guarantee levels of performance in terms of product deliveries, availability of access to system resources, and the availability of support from ESPC, either from operators or from automated Help applications. ESPC will establish similar agreements with selected NOAA offices chosen as representative of those who will use ESPC resources to develop products, including NDE's. At the present time, NDE anticipates no performance baselines different from those ESPC will provide for all of the applications that operate under its auspices.

5.4.5 Configuration Management

Important aspects of the relationship between NDE and ESPC can be illustrated in terms of Configuration Management (CM) and System Testing. New or enhanced algorithms, for example, will be run in a System Test environment that simulates ESPC operations. In order for an algorithm to be certified as Operational, it must perform without causing errors (regression testing) or degrading performance (stress testing) when using the same configuration of enterprise resources (the DBMS, object repositories, shared procedures, etc.) as those running in the ESPC operational environment. The algorithm will be submitted for System Testing as part of a package that might also include additional test data, enhanced versions of shared elements, documentation for new test procedures, and (in all cases) updated documentation for each of the enhanced components to be certified. New or enhanced enterprise tools will, likewise, be required to undergo the same level of system testing.

5.5 Long Term Archive (LTA)

The NPP and NPOESS Long Term Archive (LTA) functionality is provided by NOAA's Comprehensive Large Array-data Stewardship System (CLASS) to ensure data availability during and beyond the NPP and NPOESS missions. The LTA will archive all sensor data, including when the sensors are in diagnostic mode, and provide access to users.[1]

NDE will archive its product tailoring tools, its NOAA-unique development tools, and the NOAA-unique products. Tailored products will not be archived on the assumptions that Customers will be able to retrieve xDRs from CLASS and, using the tailoring tools provided by NDE through the CLASS interface, tailor them for their purposes

5.6 NPOESS Mission Management Center (MMC)

The SSPR performs the following functions at the MMC: Flight Operations, Satellite Operations, Mission Management, and Enterprise Management. **Note:** MMC's data flows (Figure 2) touch the ESPC boundary, not NDE's. This indicates that the interaction is between NPOESS and ESPC's operators, who are responsible for the common interfaces available to all ESPC-resident applications, including NDE.

The data flow "NPOESS Status" represents messages to the ESPC operators about conditions, either at the spacecraft or on the ground, that might have an impact on NDE data

[1] Distribution of diagnostic data will be limited to scientists and engineers supporting NPOESS cal/val efforts and members of the scientific community characterizing long-term instrument performance.

processing. Based upon predetermined circumstances, documented in an Operators' Manual, the ESPC operators determine whether the message should influence NDE processing. If so, they will carry out the actions necessary to accomplish the change. In some cases, they may inform NDE management of the message content. In turn, NDE management can authorize NDE process changes.

"Trouble Tickets" are sent by ESPC operators to notify NPOESS that NDE has detected conditions in XDRs that require attention. The MMC's Enterprise Management System (EMS) is the function that accepts NDE Trouble Tickets as well as "Work Requests." Work Requests are more specific than Trouble Tickets in that they suggest changes to NPOESS.

The EMS maintains a Work Request System (WRS) with a Graphical User Interface (GUI) permitting authorized personnel at the Central to submit Trouble Tickets or Work Requests. Internal NPOESS procedures, including submission of Work Requests to the NPOESS Change Control Board (CCB), will determine a response to any Work Request. The results of these procedures as well as the status of actions taken in response to Trouble Tickets will be available to ESPC operators as "Work Request Status" messages through the WRS interface.

NDE serves as the representative of NOAA's users to the NPOESS program. Certain requests will be forwarded to the IPO in the event that they cannot be satisfied by NDE. The IPO is responsible to a tri-agency board for developing, implementing, operating and maintaining NPOESS. The IPO has an obligation to the tri-agency boards to produce products that satisfy the threshold and strive for the objective performance of products listed in the IORD and, in the future, preplanned product improvements.

5.6.1 Official Ancillary Data

To generate EDRs, the IDPS acquires ancillary data from external sources via the C3S Data Routing and Retrieval (DRR) and the NOAA Central LAN. Ancillary data is data that is not produced by the NPOESS system but which NPOESS EDR algorithms require to deliver the EDR attributes as documented in the NPOESS System Specification's Appendix D (e.g., terrain height data base, conventional surface and atmospheric observations, 12 hour temperature forecasts, etc.).

Periodic transfers such as FTP transfers are initiated by the IDPS according to a schedule. Notification transfers allow external sources to notify IDPS when updated ancillary data is available. All "official" ancillary data, including backup data, whether or not used, is sent by the IDPS to the LTA for archiving.

5.6.2 xDR Subscription Requests

Requests for data products will be submitted either through a GUI form or as an Application Program Interface (API), both of which will be maintained and supported by IDPS. Requests may be "standing" or "ad hoc." Standing requests are used to receive repeated data product delivery. Ad hoc requests are used to receive specific products over a specific time range or geographical region. As soon as the ad hoc request is fulfilled, the request expires. Data requests are made via a local electronic interface or through a web-based mechanism.

Depending on the preference chosen on the request from NDE or recorded in the user profiles in the IDPS, the product will either be sent directly to NDE for distribution to the user, or the user will be notified how the requested information product can be retrieved. NDE (and civil users through NDE) will be given an opportunity to provide feedback to the IDPS about the process responsiveness and the utility of the data provided. NDE will also provide reports on the timeliness, quality, and availability of the data delivered.

It is the responsibility of the NDE system to pull/receive the xDRs from IDPS.

5.6.3 The xDR Data Flow

5.6.3.1 Format

The IDPS will make available requested xDRs to the NDE system as the products are produced. All IDPS processed data and its associated metadata are stored as Hierarchical Data Format v5 (HDF5) files. All xDRs sent to the NDE system will be in this format.

The IDPS stores xDRs as "granules" for a period of 24 hours. Storage is based on the data type and descriptive metadata that corresponds to the desired data. A granule is a contiguous temporal segment of data. The boundary between one granule and the next granule occurs at the completion of a scan line or collection intervals. The size of a granule will vary by sensor, but will be a constant number of scan lines or a collection interval for each sensor. By dividing the NPOESS data products into smaller segments (granules of data), the IDPS processes many granules concurrently across multiple high performance processors to achieve the NPOESS EDR latency requirements. Since granule boundaries are chosen to optimize processing, they are different from Stored Mission Data (SMD) transmission boundaries, which are a function of contact time with the spacecraft. The last RDR granule received in an SMD transmission is likely to be incomplete. Therefore, the first sensor data in the new SMD transmission must be combined with the sensor data in the last SMD transmission to assemble a complete RDR granule.[9]

Studies are ongoing to determine the precise delivery protocol of granules/files. Once the data is received within the NDE architecture, the data will be delivered to end users in HDF5 or, in some circumstances, be converted from HDF5 to formats required by the internal legacy product application or the end user.

5.6.3.2 Quality Control of xDRs

NDE is assured that the data it receives from the IDPS will conform to the quality thresholds defined in the IORD. At all times, the SSPR will monitor the performance of the payload sensors and perform operational level calibration and validation of algorithms. The IPO Data Quality Engineer (DQE) provides updates to application processing coefficients used in IDPS processing and updates to sensor calibration tables for uplink to the satellites.

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[9] There may be a need for greater overlay between orbital/granule segments depending on the specific product requirements

The SSPR is responsible for the quality of EDRs produced by the IDPS Element using Configuration Control Board (CCB) approved inputs and algorithms; even though NOAA has the flexibility of using different sets of ancillary data as input to their unique product algorithms. The IPO's responsibility ends after it has made products available and supported the ensuing delivery of products.

5.7 Interoperability

The NDE system components will be designed and maintained to interface with the IDPS. The IDPS will be installed and demonstrated at least one year prior to the launch of the NPP satellite. This NPP configuration will be used to debug the software and conduct the calibration and validation of the VIIRS, CrIS, ATMS, and OMPS sensors and their products. The IDPS will then be upgraded/replaced prior to the launch of the first operational NPOESS. As part of its evolutionary development, the NDE system will also be upgraded to ensure interoperability.

6 Operational Scenarios

6.1 Quality Assurance

6.1.1 Ingest Quality Control

Upon receipt of an xDR from the IDPS, before routing for distribution and/or additional processing, NDE will examine three external characteristics of the data package:

- Size, to test whether the data package received is the same as the one that was sent,
- Quality Flags, to determine whether NPOESS marked the data package to indicate that special handling might be required
- Metadata, to determine whether the data package includes the information necessary for retrospective processing (i.e., climate studies, archive retrieval, reprocessing, etc.)

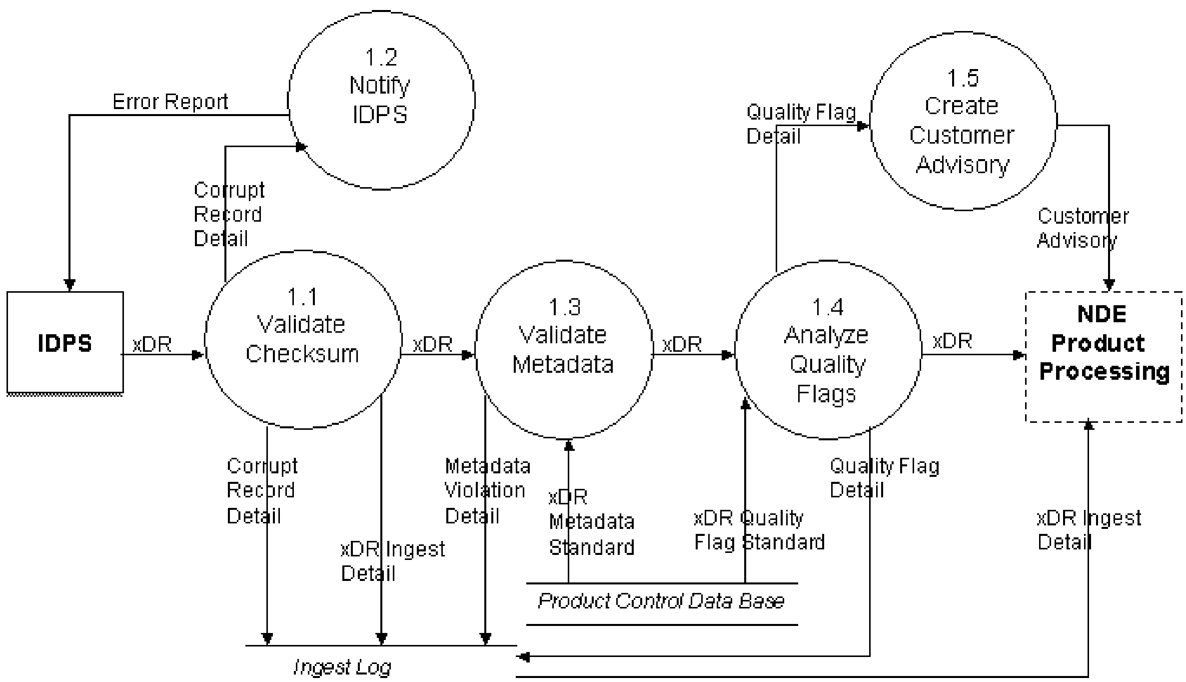

Figure 5.1.1 Ingest Quality Control

6.1.1.1 Ingest Log

For each granule received by NDE, a record of the date and time the data package was received, along with the granule's unique identifier, will be created as an xDR record by the "Validate Checksum" procedure,. Additional information will not be added to this record unless a problem is detected. The xDR Ingest Detail will be established and reside in the Ingest Log, available for update throughout the Ingest Quality Control cycle. (Figure 5.1.1)

If a problem is detected during the Ingest Quality Control cycle, the Ingest Detail will be updated with the appropriate information. In such an event, a copy of the Ingest Detail will be created and sent to the Product Processing subsystem along with the xDR. (This does not preclude access to the Ingest Log by a Product Processing subsystem if its internal rules require the date and time of ingest.) The presence of an xDR Ingest Detail is an indication to the processing subsystem that special actions might be required. The interpretation of the Ingest Detail record's content, including the determination of any actions that might be required, is the obligation of the Product Processing subsystem associated with the xDR.

The Ingest Log will be sent to CLASS at regular intervals (TBD) to provide the permanent history of granule transmission between NPOESS and NOAA. After transmission to CLASS, the Ingest Log will be purged of the archived xDR Ingest Detail records.

6.1.1.2 Product Control Data Base

A. Quality Flags

The IDPS evaluates the quality of satellite data during the creation of xDRs. IDPS assesses data quality according to whether the products meet the delivery standards established in the IORD and published in the External Data Format Control Book (EDFCB). Should NPOESS detect data values outside of these published thresholds, Data Quality Management (DQM) procedures will be invoked to investigate the problems. Among these procedures are creation and transmission of a Quality Flag that will accompany the xDR and indicate the nature of the deficiency. NDE, then, can adjust its processing appropriately. *However, in all cases, the data will be delivered to NDE.*

This approach obligates NDE to establish written Standard Operating Procedures to detect the presence of Quality Flags and to respond appropriately. For example, compensatory adjustments to operands might be possible for some predictable types of data deficiencies. In other cases, normal processing might continue. Of course, there will be cases when the products are simply unusable. For mission-critical products, NOAA's instrument experts may be notified to help work the problem. Programmers and operators may be notified or asked to perform predetermined tasks. Whether Customers are to be informed will also be determined.

To the extent possible, it is desirable for these procedures to be automated and to take place at the earliest possible stage in the product life cycle. Accordingly, NDE will establish and maintain a database of machine-readable information about how each product processing subsystem is to respond to Quality Flags. Representatives for each subsystem will be responsible for determining the values contained for its xDRs. Access to the data base by the Analyze Quality Flag process is shown in Figure 5.1.1.

B. Metadata Standards

Imposition of a single checkpoint for the quality control of metadata supports the needs of a broad community of current and future users of polar satellite data.

6.2 Requests for NPOESS Data

The primary method the NDE system's operators will use to request data (for themselves and NOAA civil users) from the IDPS is through a web-based graphical user interface mechanism enabling data to be selected based on satellite, sensor, data product type, channel, spatial extent, and temporal extent. To request a product, the NDE operator will start a web browser, enter the web address for the IDPS, and log in to a menu-driven interface.[13]

The NDE operator has two options for requesting data; ad-hoc and standing requests. Ad-hoc requests are limited-time requests for data in a certain region or for a specific timed event and can be used to request one-time delivery of a NPOESS data product or to request repeated deliveries through a specified time period. Ad-hoc requests expire after they have been filled. Standing requests refer to regularly scheduled requests for data products to meet recurring requirements; standing requests do not expire when filled. This interface provides the NDE system with the capability to generate, modify, or delete requests as well as monitor the status of existing requests.

To generate an ad-hoc request, an NDE operator will perform the following steps through the interface:

- Types in a request name
- Filters the data products display (if desired) by entering product type (e.g. EDR, SDR), sensor, or spacecraft
- Chooses the specific product (e.g. Aerosol Optical Thickness) or products
- Selects the 'Ad-hoc' request type
- Selects aggregation and length of aggregation (if desired)
- Enters data about the area of interest such as latitude/longitude and time of observation
- Sets a distribution time, which is either 'as available' or at a user-defined time
- Selects the destination(s) for the data
- Selects the submit button

For standing requests, an NDE operator follows the same process but chooses 'Standing' request type instead of 'Ad-hoc'. The user is then given the opportunity to specify a distribution time:

- 'As available' – data are packaged and shipped as soon as the data arrives
- Periodically – for example, every satellite space-to-ground downlink communication
- After the specified amount of data are gathered – for example, one orbit

[13] A configurable number limits the number of concurrent users.

Once requests have been made, ESPC has the ability to do the following:

- Suspend or resume requests
- Modify existing requests
- Use existing requests as a template for a new request
- Delete requests
- Request a retransmission

For any active request, the NDE operator can monitor the real-time status of the request for the information listed below:

- A User defined name and unique ID for the request
- The product type
- The destination of the requested data
- The last time the request was fulfilled
- An estimate of the next time the data request is to be fulfilled
- The status of the request (e.g. waiting, formatting, transferring)
- Messages

An alternate method available to the NDE system to request and receive data is through an Application Program Interface (API). The API invoked by an NDE application program sends a request to the IDPS for data. The API is a set of library functions that are resident on NDE's machine that will make the data request. These library functions are part of the IDPS distributed software and must be installed on the NDE machine (IBM AIX and Microsoft Windows 2000 are supported operating systems). NDE may make API calls using C, C++, or Fortran. There are two different types of API available to NDE: an API that delivers files and an API that streams raw data to NDE. To use either one of the API's, NDE embeds the library function calls into its application; these function calls are executed when the application is run. These function calls contain all of the necessary information to select a particular data product. A Username and password is required to authenticate the request. If the request fails to be authenticated or the request parameters are invalid, the requesting application is sent an error message indicating the problem.

The API that delivers files has the same exact functionality that the GUI provides. This API can place both 'Standing' and 'Ad-hoc' requests and accepts all the parameters that can be entered using the GUI. All of the functionality that is present in the GUI can also be found in the file delivery API (e.g., suspend, delete). Once the API has submitted the request, the IDPS fulfills the request based on the request parameters and returns a file for retrieval by ftp.

Parameters to be supplied include SpaceCraft, Sensor, and Product. Data requests (via the GUI or API) may also include several optional criteria. These options include: Temporal Range, Spatial Range, Orbit. In addition, NDE may specify that individual granules satisfying the request be aggregated into a larger file or delivered as separate granules.

There are two defined methods of transferring data from IDPS:

- File Transfer Protocol (ftp) for NPP only (State 1)
- File Transfer Protocol over SSL (ftp-s) for NPP and NPOESS (States 2 and 3)

For ftp and ftp-s, files are written in HDF5 format.

6.3 Customer Order Management

ESPC will provide a secure subscription capability that will allow customers to order products online. "Products" are either unchanged xDRs as received by NDE from the IDPS, or repackaged xDRs, or NOAA-unique products. Customers will be able to view the available products with an online capability similar to the current SATPROD database. The product list will be linked to an NDE subscription form allowing product selection directly from the list.

Customers will be able to place orders for products on a standing basis (e.g., a "subscription") or as an *ad hoc* request for specific NDE product(s) for a designated period of time. A*d hoc* orders expire once the order is fulfilled. A customer may place an *ad hoc* order in addition to a standing subscription.

The process associated with a customer's initial order will be NDE's primary means for capturing customer information. Products will be distributed only to those select NOAA customers who have provided NDE with a "customer profile" that includes organizational, contact, and electronic connection information. Customers will be eligible to receive products after their profiles have been approved by an NDE administrator. Customers will have online, update access to their customer profiles and subscriptions. Security procedures (TBD) will ensure that no one other than authorized users will be able to update data items associated with customer profiles and orders.

An "order", whether standing or *ad hoc*, will specify the product(s) requested, the delivery schedule desired, the means of delivery ("push" or "pull"), and the delivery address (if available for a particular product), tailoring options (i.e., geolocation, data format, projection scheme, etc.) will be included on the order. The default form of any product will be the HDF5 version provided by the IDPS. NDE will offer tailoring options selectively, on a product-specific basis.

The delivery schedules available will be limited to near-real time; products will be distributed as soon as possible after receipt from the IDPS. 77% of the data will be delivered to NDE by the IDPS within 15 minutes from observation. 95% of the data will be delivered within 28 minutes. The average data delivery interval from observation to receipt by NDE will be less than 10.5 minutes. Tailoring and NOAA-unique processes will be applied as soon as possible after receipt of the necessary xDRs. It is expected that the processing of tailored products not requiring external data sources will no more than five minutes to the overall delivery speed.

If an order must be recreated within 24 hours of its scheduled delivery time, NDE will reprocess the product using the appropriate xDRs from NDE's 24 hour repository. Replacements for products delivered more than 24 hours previously will be obtained by customers from the Long Term Archive.

NDE will have the capability to withhold orders (e.g., "deny data") to unauthorized users when directed by National Command Authority through the Department of Defense. Authorized users (U.S. Government agencies and selected foreign meteorological offices with whom NOAA has formal agreements for the sharing of satellite data) will be informed immediately of these "data denial" events. In turn, the authorized users must not disseminate the NDE data to any of their downstream customers unless they have been authorized as recipients according to standards (TBD) that will be provided by the Department of State.

Orders for product tailoring tools will be placed with the LTA; NDE will not provide them directly to customers. However, NDE's available Customer Services will include Help with regard to tailoring tool usage.

NDE will provide reports on the timeliness, quality, and availability of all orders.

6.4 NPOESS Data Denial

For NPP, following DoD determination as circumstances warrant, data denial of the NPP HRD can be implemented by turning the HRD broadcast off. For the NPOESS satellites, following DoD determination as circumstances warrant, data denial of NPOESS direct broadcast and SMD will be implemented through data encryption; the A-DCS and SARSAT downlinks and A-DCS/SARSAT data included in the SMD, HRD, and LRD links will not be denied. Authorized users, including the C3S and decryption registered field terminals, will have the capability to automatically decrypt the data downlinks. The NOAA Assistant Administrator for Satellite and Information Services will be notified when data denial has been authorized.

When data denial has been enabled, the NDE system and CLASS/LTA will ensure unauthorized users do not receive the appropriate data. There are a number of technical solutions that can be pursued.

1. Develop advanced dissemination capabilities that enable an operator to quickly isolate unauthorized users from getting data. Server and internet technologies can be part of these capabilities. For example, FTP sites or portions of FTP sites could be restricted to specified ". mil" or ".gov" addresses.
2. IDPS product generation and distribution system could be upgraded to allow NOAA to specify whether a product should be data denied automatically if regional and data type requirements are met.

6.5 Science Support

Calibration, validation and unique command activities will require additional sensor command activities. Related requests will be submitted by the NOAA Central through the IDPS to the Operations Director and the MMC for approval and execution.

6.6 Algorithm Support Capability

The NOAA Central will use the algorithm support capability to support activities ranging from algorithm development to testing algorithms in parallel to Operations using the SMD stream from the NPOESS/NPP satellites. The algorithm support capability aggregates the algorithm development and algorithm support features provided by the IDPS at the NOAA Central. The Algorithm Development Area (ADA) consists of one or more domains within the Integration and Test (I&T) IDP string where the domains are used for software development activities in support of developing algorithm modifications and prototype algorithms. The ADA resides in a logical partition on the I&T String and supports the capability to test new algorithms against pre-recorded or live SMD without the results being delivered into the production data stream. The Algorithm Support Area is a location in the Central facility where scientists/algorithm developers have workstations to access the Algorithm Support Capability to develop and test algorithms. For a NOAA user to use the ADA to modify an existing algorithm, the user must first obtain the algorithm, data sets, etc. from the NOAA Central. The next step is to log on to the ADA as an authorized user. The user will then modify the algorithm as desired and execute the algorithm against static data sets; the I&T Cal/Val can be used for analysis. Once completed, the test results from the modified algorithm will be sent to NOAA Central test users for evaluation. Once the modified algorithm is accepted by the NOAA Central test users, it will be submitted to the IPO for CCB evaluation. (See Section 3.2.2 for NDE/NPOESS shared use description.)

6.7 Impact of Satellite Maneuvers

NPOESS Mission Management Center (MMC), housed at the NOAA Central, will alert NESDIS of all planned satellite maneuvers and also provide data on the results of such maneuvers. MMC will also provide this information to the LTA.

Orbit changes are accomplished by reorienting the satellite to burn attitude, then implementing the rocket firing process; maneuvers are performed using thrusters (versus reaction wheels). Both maneuvers and burns occur in eclipse (for inclination changes only). Satellite maneuvers are made under three specific instances: Orbital insertion trim, Drag Make-up, and Inclination Adjustments. During maneuvers, the satellite will continue to collect all available sensor data. Scheduled on-orbit mission data collection resumes after maneuver operations are concluded.

During Orbital Insertion trim an ‘Altitude Increase’ maneuver is required to eliminate any orbital injection abnormalities following launch vehicle separation. This occurs once in each satellite’s operational lifetime at beginning of life.

Drag make-up maneuvers require an ‘Altitude Increase’ maneuver to eliminate the effects of orbital drag on ground track parameters. They also satisfy the VIIRS refresh rate requirements and the requirement to prevent satellite contact time conflicts at the ground receptors and ground stations. For the satellite carrying the Altimeter, it is predicted that the ground track requirement imposes executing a drag make-up maneuver every 2 months during peak solar activity and every 7 months during minimum solar activity. For the other satellites, it is predicted that the VIIRS refresh rate and contact conflict prevention requirements impose executing a drag make-up maneuver once a year during peak solar activity and once every several years during minimum solar activity. The sensors are left in operational mode for drag make up maneuvers.

An ‘Inclination Adjustment’ maneuver eliminates the effects of orbital dynamics on the inclination of the satellite. Inclination changes are infrequent: one is planned in the first year and another during the third year of the mission.

6.8 SARSAT/A-DCS

The NPOESS space segment incorporates components of the SARSAT system and Advanced Data Collection Subsystem (A-DCS). The onboard SARSAT transponder receives signals from emergency location transmitters (ELT) and relays the information to any SARSAT local user terminal (LUT) within the satellite’s field of view. This data is forwarded through the SARSAT system to the SARSAT Mission Control Centers, where it is distributed to international search and rescue teams. The onboard component also includes an instrument that performs onboard processing; i.e., the Search And Rescue Processor (SARP). The SARP generated products are interleaved in the broadcast to the LUTs (not sent down in the SMD).

The only SARSAT data that comes through at the Central interface is the telemetry. The IDPS forwards these data to the NOAA Central for distribution to the US SARSAT Mission Control Center (USMCC).

SARSAT telemetry is also included within the SMD downlink. The IDPS processes this telemetry into RDRs and provides it to the NOAA Central for distribution to the USMCC. The NOAA Central is also responsible for distributing the following information from the IDPS to the USMCC; NPOESS auxiliary data[2], notification of planned NPOESS operations (i.e., maneuvers) that may impact the SARSAT mission, and periodic NPOESS activity reports. In the event of ad hoc NPOESS activities or anomalies that may impact the SARSAT mission, the NPOESS Associate Director for Operations will notify the USMCC directly.

Mission data and full orbit housekeeping telemetry from the A-DCS are transmitted in the SMD and processed by the IDPS. On a specified basis, the IDPS provides the A-DCS mission data and sensor telemetry to the NOAA Central for distribution to the US Global Processing Center (USGPC). The NOAA Central is also responsible for distributing the following information from the IDPS to the USGPC; NPOESS auxiliary data, providing notification of any planned NPOESS operations that may impact the A-DCS mission, and periodic NPOESS activity reports. In the event of ad hoc NPOESS activities or anomalies that may impact the A-DCS mission, the NPOESS Associate Director for Operations will notify the USGPC directly.

6.9 NDE Problem Resolution

Three basic types of problems are anticipated with the NDE system; network, hardware, and software/configuration based. When a problem is detected, operations will be redirected to a hot

[2] Auxiliary data are data types produced by NPOESS that are not sensor data but which the NPOESS EDR algorithms require to deliver the attributes documented in the NPOESS System Specification (e.g., ephemeris data, sensor calibration coefficients, sun angles, etc.).

backup set of resources either automatically or by the NDE system operator; the NDE system will be programmed to alert the NDE system operator when a failure is detected, allowing the operator to initiate a fault detection routine. The recovery concept is that since the NDE system has a 100% reserve capability, the first step is to replace the problematic unit with an onsite spare. If reserve capability is not available, logistic spares will be used to return the NDE system to operations as soon as possible; these spares are the responsibility of NESDIS. If service will be degraded, the NDE system operator will follow Standard Operating Procedures, including notification of OSDPD management.

If no hardware or network failures are indicated, but a system malfunction has been identified, the first step is to determine whether the problem is being experienced at all four Centrals or whether it is unique to the NDE system. If the problem is found to be unique to the NDE system, a decision will be made whether or not to conduct a clean install of the current configuration of NDE software. If the problem is common to all Centrals or a clean install of the NDE software does not clear the problem, a decision will be made by the NDE operator on what the next step will be and the urgency with which it is taken. If the problem has an impact on critical production or impacts other Centrals, the problem will be worked immediately. If the impact is not critical, the problem will be worked during regular hours. The NDE operator's response to a problem will be driven by Standard Operating Procedures.

6.10 Homeland Security

TBD

6.11 Contingency Operations

Contingency of operations will be required for localized non-critical failures as well as catastrophic failures of the entire NOAA Central. The criticality and timeliness of the response will be dependent on the local action plans defined within the framework of the NOAA Continuity of Operations Plan (COOP).

In the event of a failure of the entire NOAA Central or one of its components, continuity of products and services is essential to the NPOESS system and user community. These products and services are anticipated to be provided through local actions (e.g., onsite sparing) and transitions to remote redundant services. For example, in the event of a local power loss, the NOAA Central is responsible for ensuring the availability of power and environmental services to the local NPOESS systems. In the event of a failure of the CLASS-Suitland interface, the CLASS Asheville site will provide an interface to archive and access services.

In general, localized non-critical failures will be handled through onsite sparing and temporary periods of degraded service. Critical functionality will be immediately backed up through onsite or remote redundant systems; e.g., in the event of a total failure of the NOAA Central, it is anticipated that needed ancillary data will be provided by the other IDPS systems.

7 SUMMARY of IMPACTS (TBD)

7.1 Organizational Changes

7.2 Technology Changes

8 ANALYSIS OF PROPOSED SYSTEM

This section to be completed by the NDE/ESPC development team by June 30, 2006

9 NOTES

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10 Appendices

10.1 Acronym List

A-DCS	Advanced Data Collection System
AFWA	Air Force Weather Agency
APS	Aerosol Polarimeter Sensor
ATMS	Advanced Technology Microwave Sounder
AWIPS	Advanced Weather Interactive Processing System
C1	NPOESS First Satellite
C2	NPOESS Second Satellite
C3	NPOESS Third Satellite
CASE	Computer Assisted Software Engineering
CDR	Climate Data Records
CDR	Critical Design Review
CE	Capital Expenses
CLASS	Comprehensive Large Array-data Stewardship System
CM	Configuration Management
CMIS	Conical Scanning Microwave Imager/Sounder
CO	Contract Officer
CONOPS	Concept of Operations
COOP	Continuity of Operations Plan
COR	Contract Officer Representative
CM	Configuration Management
CrIS	Cross-Track Infrared Sounder
CrIMS	Cross-Track Infrared Sounder + Advance Technology Microwave Sounder
DBA	Data Base Administrator
DBMS	Data Base Management System
DCS	Data Collection System
DMSP	Defense Meteorological Satellite Program
DoA	Department of Agriculture
DOC	Department of Commerce
DoD	Department of Defense
DOS	Department of State

DRO	Direct Readout
ECMWF	European Center for Medium-range Weather Forecasting
EDR	Environmental Data Record
EOS	Earth Observing System (NASA)
ERD	Entity Relationship Diagram
ESPC	Environmental Satellite Processing Center
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration
FNMOC	Fleet Numerical Meteorology and Oceanography Center
FOC	Final Operational Capability
HDF	Hierarchical Data Format
HDF5	Hierarchical Data Format version 5
I&T	Integration and Test
IDPS	Interface Data Processing Segment
IORD	Integrating Operational Requirements Document
IPO	Integrated Program Office
IPP	Integrated Program Plan
ITAT	Information Technology Architecture Team
JARG	Joint Agency Requirements Group
JCSDA	Joint Center for Satellite Data Assimilation
KPP	Key Performance Parameter
LTA	Long-term Archive
METOP	Meteorological Operational
MMC	Mission Management Center
NAVOCEANO	Naval Oceanographic Office
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction
NDE	NPOESS Data Exploitation
NEB	NOAA Executive Board
NGDC	National Geophysical Data Center
NIC	National Ice Center
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NOS	National Ocean Service
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project
NSOF	NOAA Satellite Operations Facility
NWS	National Weather Service
O&M	Operations and Maintenance
OAR	Office of Atmospheric Research
OMB	Office of Management and Budget
OPC	Ocean Prediction Center
ORA	Office of Research Applications
OSD	Office of Systems Development
OSDPD	Office of Satellite Data Processing and Distribution
PD	Product Development
PDR	Preliminary Design Review
PIR	Post Implementation Review
POES	Polar-orbiting Operational Environmental Satellite
POP	Product Oversight Panel
PPBES	Project Planning, Budgeting, and Evaluation System
PPI	Plan For Product Implementation
PPI	Program Planning and Integration
PSDI	Product Systems Development and Implementation
R2O	Research To Operations
RDBMS	Relational Data Base Management System
RDR	Raw Data Record
RTS	Requirements Tracking System
SARSAT	Search and Rescue Satellite Aided Tracking
SDLC	System Development Life Cycle
SDR	Sensor Data Record
SDS	Scientific Data Stewardship
SDS	Science Data Segment (NASA)

SMB	Senior Management Board
SRR	System Requirements Review
SST	Sea-Surface Temperature
STI	Science and Technology Infusion
SUAG	Senior Users Advisory Group
TBC	To Be Confirmed
TDR	Temperature Data Record
UKMetO	United Kingdom Meteorology Office
USMCC	United States Mission Control Center
VIIRS	Visible/Infrared Imager Radiometer Suite
WBS	Work Breakdown Structure
xDR	any NPOESS Data Record

11 GLOSSARY

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